STEP AWAY FROM THE ZERO LOWER BOUND:
SMALL OPEN ECONOMIES IN A WORLD OF SECULAR STAGNATION

We study how small open economies can engineer an escape from deflation and unemployment in a global secular stagnation. Building on the framework of Eggertsson et al. (2016), we show that the transition to full employment requires a dynamic depreciation of the exchange rate, without prejudice for domestic inflation targeting. However, if depreciation has strong income and valuation effects, the escape can be beggar thy self, raising employment but actually lowering welfare. We show that, while a relaxation in the Effective Lower Bound (ELB) can work as a means of raising employment and inflation in financially closed economies, it may have exactly the opposite effect when economies are financially open.
Step away from the zero lower bound:
Small open economies in a world of secular stagnation

Preliminary and incomplete

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Abstract

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1 Introduction

For some years now, world economic activity and real interest rates have been chronically low, a situation that motivated Summers (2013) to raise the issue of whether the global economy may have entered a ‘secular stagnation,’ echoing Hansen (1938)—see also Eggertsson et al. (2016) and Caballero et al. (2015). In the secular stagnation envisioned by this literature, output is depressed not only due to a combination of adverse demographics, low productivity growth and financial frictions. The key problem is that desired savings cannot be absorbed at full employment, and the output gap is permanently positive, pointing to deficiencies in the policy framework. This hypothesis is by no means unchallenged. Notably, Lo and Rogoff (2015), among others, attributes the current protracted slowdown to the need for deleveraging after the build-up of private and public debt before and in the aftermath of the global crisis. Whatever its root causes, the prospect of a persistent slump at global level has made policymakers increasingly aware of the extent to which national economies are alarmingly exposed to adverse economic and financial developments abroad. After three decades of trade and financial globalization, for a typical market economy, exports are a large component of demand, and its interest rates and asset prices are highly correlated with those in world markets.

Classical open macro theory suggests that a country can insulate its macroeconomy from adverse global business cycle shocks by letting its exchange rate absorb the contraction in world demand, and improve its external surplus. In this paper, we analyse the role of this adjustment mechanism when a small open economy—heavily exposed to world variables but too small to affect them—face a situation in which the world output is chronically, rather than temporarily, depressed. We do so building on the the open economy overlapping generations models by Eggertsson et al. (2016) (henceforth EMSS) and Caballero et al. (2015) (henceforth CFG). Different from these, we model a small open economy that takes the behavior of the rest of the world as given, but still has monopoly power on its terms of trade, i.e. it faces a downward sloping demand for its domestically-produced goods.

Our main findings are as follows. First, we show that, under plausible conditions, a small open economy in a world of chronically deficient demand can embark on a path to full employment while attaining price stability. The endpoint is characterised by a permanently weaker real exchange rate, inflation at target, implying a trend depreciation in the nominal exchange rate, and, for standard trade elasticities, an improved external asset position. Since bringing the economy to full employment requires an increase in domestic inflation relative to the rest of the world, it follows that escape is not possible without exchange rate flexibility. However, along the escape path, real depreciation raises employment but reduces the in-
ternational valuation of domestic output. We show that the adverse income effects from 
depreciation can be strong enough that closing the output gap is “beggar thy-self”, that is, 
employment rises but national consumption and life-time utilities fall. In this case, the net 
external position of the country deteriorates in the transition. Its residents absorb world 
excess savings, rather than exporting their own.

Solving for the transition dynamics, we show that employment improves even if real interest 
rates rise with inflation and output—most of the change in demand and saving is driven by 
the switch in private market expectations of future output and real depreciation. Yet, there 
are possible scenarios in which, along the transition, the exchange rate overshoots its long 
run level on impact, hence upfront real and nominal depreciation is followed by a partial 
adjustment with appreciation. In the first phase of the recovery, then, the nominal interest 
rate remains temporarily stuck at the zero lower bound. Correspondingly, the real interest 
rate temporarily falls.
Finally, we show that, for a small open economy on the escape path, a number of policy 
measures that would be helpful in a temporary liquidity trap, or from the perspective of a 
closed economy in secular stagnation, can be irrelevant at best, or even counterproductive. 
Namely, cutting the interest rate by relaxing the Effective Lower Bound (henceforth ELB) 
works as a means of raising employment and inflation when the economy is financially closed. 
But it can have exactly the opposite effect when the economy is financially open. The kernel 
of the intuition is that, in an economy open to trade in assets, the terminal real interest rate is 
pinned down at the global level by uncovered interest parity, so that lower nominal rates must 
eventually translate into lower inflation, a trend exchange rate appreciation, and thereby a 
more negative output gap. Nonetheless, should the ELB bind along the escape path, relaxing 
it can help to ease and shorten the transition to full employment. Similarly, increasing 
the inflation target is irrelevant in steady state (since the real rate is set by international 
arbitrage), but can shorten the transition by fostering real depreciation.
A qualifying feature of our contribution is our focus on an open economy that, while small, 
produces a differentiated domestic good. We are thus able to provide an account of the 
real exchange rate, and analyze the role of substitution and income effects in shaping the 
transition from secular stagnation to a full-employment steady state. In a closed economy 
context, along this transition, higher employment and output prospects produce a positive 
income effect that boosts demand at each point in time—the real interest rates may actually 
rise without offsetting the increase in demand. In open economy, however, a country moving 
towards full employment must experience domestic real depreciation, for world demand to 
absorb the rising volume of domestic output—a substitution effect. But a falling price of
domestic output also reduces domestic purchasing power—producing a negative income effect. When domestic and foreign goods are sufficiently substitutable, this negative income effect are small: despite the adverse terms of trade movement, a higher volume of domestic output increases domestic income. In this case, domestic households must acquire foreign assets in order to absorb the increased savings that result from full employment. Along the transition, the country runs an external surplus.

In contrast, when domestic and foreign goods are poor substitutes, the price of home goods must fall by a larger amount to create enough demand for home output at full employment. This fall in prices can outweigh the increase in output volume, leaving domestic households poorer notwithstanding the gains in employment. The value of domestic savings also falls: fewer or even no foreign assets are acquired during the transition. Most strikingly, the escape hence creates an adverse trade-off—residents work more but consume less—which raises the possibility of welfare losses. Currency wars, in this context, can be beggar thy self, rather than beggar thy neighbors.\(^1\)

The adjustment dynamics can actually be quite rich if trade elasticities are time-varying—most plausibly, increasing over the horizon of the transition to the full employment steady state. We show that, in this case, the real exchange rate may overshoot its weaker long run level, implying real appreciation along the transition. Correspondingly, the real interest rate falls, before asymptoting back towards the world level. As a result, even though inflation goes back at target, the nominal interest rate may remain at the ELB before rising to its positive long run level.

A number of central banks have recently attempted to counter low inflation and/or lacklustre growth by reducing nominal interest rates to unprecedentedly low levels (Danmarks Nationalbank (DN), the European Central Bank (ECB), Sveriges Riksbank and the Swiss National Bank (SNB) cut interest rates to below zero during the period from mid-2014 to early 2015, and most recently the Bank of Japan (BoJ) (see Bech and Malkhazov (2016)) and BoE\(^2\) applied similar policies). In a financially closed economy, a sufficiently large reduction in the ELB on nominal interest rates up to reaching market-clearing real rates (consistent with the inflation target) can restore full employment. The same is not necessarily true in a small open economy open to trade in assets. If the economy is in a stagnation steady state, to the extent that the real interest rate is pinned down at the world level, by the Fisher equality a permanent cut in nominal interest rates must eventually reduce inflation. Given the long-

\(^1\)Welfare assessment crucially depends on the disutility from involuntary unemployment, a point recently stressed by Schmitt-Grohé and Uribe (2015). For an analysis of beggar thyself depreciation in open economy macro see Corsetti and Pesenti (2001)

run tradeoff between output and prices in EMSS, this implies a lower future level of output, raising the real exchange rate today and causing output to fall immediately. Reducing the ELB may nonetheless be helpful when the economy is already on the escape route, but, as discussed above, the nominal rate remains temporarily constrained.

There are two points worth highlighting. Firstly, in line with the recent literature reviving secular stagnation, our paper focuses on the case where the world is permanently in a liquidity trap with negative neutral rates. Yet, our analysis naturally relates to contributions that study open economies in a temporary liquidity trap, either using a two-country model, see Cook and Devereux (2013), or taking the perspective of a small open economy, see Corsetti et al. (2016). As in our contribution, also in these frameworks exchange rate adjustment is key to moderate the negative implications of a global liquidity trap for the domestic economy. In particular, the nominal exchange rate needs to depreciate persistently to allow domestic inflation to rise above the world deflationary drift. Different from our analysis, however, in these frameworks the domestic real rate must fall to boost demand—it will generally be rising in our model.

Secondly, as we focus on a small open economy, we do not discuss the cross-border spillovers that may stem from different domestic adjustment paths—amply discussed by Eggertsson et al. (2016) and Caballero et al. (2015). By no means do we mean to downplay these issues. In particular, if a sufficient number of small open economies pursue the escape path depreciating their currencies, their joint behaviour is bound to have a first-order effect on the world real interest rate and allocation. In this case, domestic policymakers might need to focus on domestic stimulus rather than relying solely on the exchange rate channel, while support from other policies, including structural policies and asset-supply policies, might be necessary to lift global neutral rates. It is precisely because each small country has a strong incentive to pursue an individual escape path from stagnation that international policy coordination may be required.

The remainder of this paper is organised as follows. Section 2 outlines the two-country model used in our analysis. Section 3 analyses the stagnation and full employment steady states. Section 4 studies how a small open economy can escape from global secular stagnation. Sections 5 and 6 discuss, respectively, alternative monetary policy measures and asset supply policies. Section 7 concludes.
2 The model

We consider a model of a small open economy under perfect foresight, integrated with the rest of the world (ROW) on both goods and asset markets. The framework is one of overlapping generations (OLG), as in Eggertsson and Mehrotra (2014) and Eggertsson et al. (2015). Each country specializes in the production of one good, but consumes both goods. With home bias in demand, this leads to fluctuations in the terms of trade and the real exchange rate. Furthermore, international asset markets are incomplete, and we assume that each country saves in terms of a CPI-indexed, real bond. In each country, households live for three periods: young, middle-aged, and old. All the income accrues to the middle aged, such that the young borrow to be able to consume subject to a borrowing constraint, whereas the old consume their savings from last period. Labour supply is exogenous, and wages are assumed downwardly sticky.

2.1 Households

Domestic households maximize

$$\max_{\{C^y_t, C^m_{t+1}, C^o_{t+2}\}}\left\{\frac{(C^y_t)^{1-\rho}}{1-\rho} + \beta \frac{(C^m_{t+1})^{1-\rho}}{1-\rho} + \beta^2 (C^o_{t+2})^{1-\rho}\right\}$$

subject to

$$C^y_t = -B^y_t$$

$$C^m_{t+1} = P_{H,t+1}/P_{t+1}Y_{t+1} + (1 + r_t)B^y_t - B^m_{t+1}$$

$$C^o_{t+2} = (1 + r_{t+1})B^m_{t+1}$$

$$-(1 + r_t)B^y_t \leq D_t.$$  

Here, $P_t$ is the consumer price index (CPI—the price of domestic consumption), $P_{H,t}$ is the producer price index (PPI—the price of domestic output), $r_t$ is the (domestic consumption-based) real interest rate, and $D_t$ is the borrowing constraint faced by the young. Furthermore, $C^i_t, i \in \{y, m, o\}$, represent consumption by the young, middle-aged, and old, respectively, and $B^i_t, i \in \{y, m\}$ are bond holdings/savings by the young and middle-aged, respectively. Finally, $0 < \beta < 1$ denotes the time-preference rate, and $\rho^{-1} > 0$ denotes the intertemporal elasticity of substitution.

We consider an equilibrium in which the young borrow all the way up their borrowing constraint

$$C^y_t = -B^y_t = \frac{D_t}{1 + r_t}.$$
Note that there are no prices appearing in the borrowing constraint, as the borrowing limit is defined in real terms (as is the bond). The middle-aged satisfy an Euler equation

$$(C^m_t)^{-\rho} = \beta(1 + r_t)(C^m_{t+1})^{-\rho}$$

while the old consume all their savings from last period

$$C^o_t = (1 + r_{t-1})B^m_{t-1}.$$ 

By combining these equations, we obtain the equilibrium consumption of the middle-age generation

$$C^m_t = \left(1 - \frac{1}{1 + [\beta(1 + r_t)^{1-\rho}]^{-\frac{1}{\sigma}}}ight) \left[ \frac{P^H_t}{P^t} Y_t - D_{t-1} \right]$$

and the old

$$C^o_t = (1 + r_{t-1}) \left( \frac{1}{1 + [\beta(1 + r_{t-1})^{1-\rho}]^{-\frac{1}{\sigma}}} \right) \left[ \frac{P^H_{t-1}}{P^t_{t-1}} Y_{t-1} - D_{t-2} \right].$$

The savings of the middle-age generation

$$B^m_t = \frac{1}{1 + [\beta(1 + r_t)^{1-\rho}]^{-\frac{1}{\sigma}}} \left[ \frac{P^H_t}{P^t} Y_t - D_{t-1} \right]$$

coincide with the gross savings of the economy.

### 2.2 Goods market integration

We assume the domestic consumption basket is made up of domestically-produced and ROW-produced goods as follows

$$C^i_t = \left(1 - \omega\right)^{\frac{1}{\sigma}} (C^{i}_t)_{t}^{\frac{1}{\sigma}} + \omega^{\frac{1}{\sigma}} (C^{i}_t)_{t}^{\frac{1}{\sigma}}, \quad i \in \{y, m, o\},$$

where $C^{i}_t$ is demand for the domestically-produced, $C^{i}_t$ demand for the ROW-produced good, and where $0 \leq 1 - \omega \leq 1$ is the degree of home-bias in consumption and $\sigma > 0$ the intratemporal elasticity of substitution. Expenditure minimization interlinks consumer and producer price indexes as

$$P_t = \left[(1 - \omega)(P^H_t)^{1-\sigma} + \omega(P^F_t)^{1-\sigma}\right]^{\frac{1}{1-\sigma}},$$

where $P^F_t$ is the price of the ROW-produced good (expressed in terms of domestic currency). We assume the law of one price holds at the level of each good

$$P^H_{t} = \mathcal{E}_t P^H_{t}, \quad P^F_{t} = \mathcal{E}_t P^F_{t}.$$
where $E_t$ is the nominal exchange rate (the price of foreign currency in terms of domestic currency) and where an asterisk indicates variables in the ROW (here: the price of the domestic and the ROW-produced good, expressed in terms of foreign currency). Then, the domestic terms of trade (the price of imports in terms of exports) are given by

$$
S_t = \frac{P_{F,t}}{P_{H,t}},
$$

and the real exchange rate (the price of ROW-consumption in terms of domestic consumption) obtains from

$$
Q_t = \frac{E_t P^*_t}{P_t}.
$$

### 2.3 Asset market integration

We assume that domestic and foreign households can, in addition to their saving in CPI-denoted bonds, also save in non-indexed bonds which pay in terms of domestic and foreign currency, respectively. All these bonds are in zero net supply, such that we may ignore them in the household problem above. However, as a result, the following no-arbitrage conditions have to be satisfied in equilibrium

$$
(1 + r_t^*) = (1 + i_t^*) \frac{P^*_t}{P_{t+1}^*},
$$

$$
(1 + r_t) = (1 + i_t) \frac{P_t}{P_{t+1}},
$$

$$
(1 + i_t) = (1 + i_t^*) \frac{E_{t+1}}{E_t}
$$

where $i_t$ ($i_t^*$) is the domestic (foreign) nominal interest rate. The first two equations are the Fisher equations in the domestic and foreign country, respectively, while the last equation is an interest parity condition.

### 2.4 Firms and labor market

Output is produced using labour from residents of the respective country, according to

$$
Y_t = L_t^\alpha,
$$

where $0 < \alpha \leq 1$. Optimality requires $W_t = P_{H,t} \alpha L_t^{\alpha-1}$. Moreover, we adopt the specification in Eggertsson and Mehrotra (2014) and assume that nominal wages are downwardly sticky of degree $0 \leq \gamma \leq 1$:

$$
W_t = \max\{\tilde{W}_t, W_t^{\text{flex}}\},
$$

where $W_t^{\text{flex}} = P_{H,t} \alpha (L')^{\alpha-1}$ (here, $L' > 0$ denotes full employment), and $\tilde{W}_t$ is a wage norm which solves

$$
\tilde{W}_t = \gamma W_{t-1} + (1 - \gamma) W_t^{\text{flex}}.
$$
2.5 Market clearing

Because the domestic economy is small, the CPI in ROW will correspond to the price of foreign output, \( P_t^* = P_{F,t}^* \), from which follows

\[
Q_t = \frac{P_t^* E_t}{P_t} = \frac{P_{F,t}}{P_t} = S_t \frac{P_{H,t}}{P_t}.
\]

(12)

Domestic goods market clearing is then given by

\[
Y_t = (1 - \omega) \left( \frac{P_t}{P_{H,t}} \right) ^\sigma C_t + \omega S_t Y_t^* ,
\]

(13)

where \( C_t := C_t^y + C_t^m + C_t^o \) denotes aggregate domestic consumption. Furthermore, asset market clearing requires

\[
NFA_t = B_t^y + B_t^m = \frac{-D_t}{1 + r_t} + \frac{1}{1 + [\beta(1 + r_t)]^{-\frac{1}{1-\alpha}}} \left[ \frac{P_{H,t} Y_t - D_{t-1}}{P_t} \right] ,
\]

(14)

where \( NFA_t \) is the domestic country’s net foreign asset position. In each period, this is the difference between the saving of the middle-aged generation (net of the payment of their debt to the old) and the consumption of the young. From the households’ budget constraint, the flow budget of the domestic country is

\[
C_t + NFA_t = (1 + r_{t-1}) NFA_{t-1} + \frac{P_{H,t}}{P_t} Y_t ,
\]

(15)

2.6 Phillips Curve and Monetary policy

Using the production function (10) together with the wage norm (11), Eggertsson and Mehrotra (2014) derive a Phillips curve of the form

\[
Y_t = \left[ \frac{Y_t \frac{\gamma}{1-\gamma} \Pi_{H,t} + (1 - \gamma)(Y^f)^{\frac{\gamma}{1-\gamma}}}{\Pi_{H,t}^{\frac{\gamma}{1-\gamma}}} \right]^{\frac{\gamma}{1-\gamma}}
\]

(16)

whenever \( \Pi_{H,t} := P_{H,t}/P_{H,t-1} < (Y^f/Y_{t-1})^{1-\alpha} \), and

\[
Y_t = Y^f
\]

(17)

else, where \( Y^f = (L^f)^{\alpha} \) is output under full employment. Note that the Phillips curve is a function of current, not expected inflation.

We posit that the monetary authorities target inflation subject to a zero-bound constraint on nominal rates:

\[
\Pi_{H,t} = \bar{\Pi} \text{ subject to } i_t \geq 0,
\]

(18)
If inflation falls below target, nominal rates fall to zero:

\[ i_t = 0 \quad \text{if} \quad \Pi_{H,t} < \bar{\Pi}. \quad (19) \]

So, once the economy is in a stagnation steady state and policy rates are at the zero lower bound, nominal interest rates are inelastic to current as well as target inflation: a change in the inflation target per se does not affect agents expectations about the current and future monetary stance.

### 2.7 Rest of the world and equilibrium at global level

In modelling the Rest Of the World (ROW), we assume symmetry in economic structure with the small open economy, except for size and policy parameters.

**Assumption 1.** The small open economy and the Rest Of the World (ROW) have the same degree of risk aversion, time preference, inflation target, curvature of the production function, full-employment (per capita) output, degree of downward stickiness. Moreover, we let \( D^*_t = D_t \) for all \( t \).

Since the domestic economy is small, the rest of the world effectively is a closed economy, so we can drawing on the main results by Eggertsson and Mehrotra (2014). Specifically, we posit that \( D^* \), the borrowing limit imposed on the young, is sufficiently tight that the ROW is in a secular stagnation steady state. Given a sufficiently tight constraint, inflation and output \((\Pi^*, Y^*)\) jointly solve

\[
D^*\Pi^* = \left( \frac{1}{1 + [\beta(\Pi^*)^\gamma - (1 - \rho)]^{-1/\gamma}} \right) [Y^* - D^*] \quad (20)
\]

as well as

\[
Y^* = (Y^f)^* \left( \frac{1 - \gamma^*/\Pi^*}{1 - \gamma^*} \right)^{\gamma^*/(1 - \gamma^*)}, \quad (21)
\]

where we have used the fact that \( i^* = 0 \) such that \((1 + r^*) = (\Pi^*)^{-1}\) from the Fisher equation (7). It is easy to show that, in this steady state, both \( \Pi^* < 1 \) and \( Y^* < (Y^f)^* \)

\[
(1 + r^*) = (\Pi^*)^{-1} > 1, \quad (22)
\]

In a secular stagnation, the market rate is positive and higher than the *natural* real interest rate (the real interest that would prevail absent nominal rigidities)

\[
(r_{nat}) = \frac{D^*}{1 + (r_{nat})^*} = \left( \frac{1}{1 + [\beta(1 + (r_{nat})^*)^{1-\rho}]^{-1/\rho}} \right) [(Y^f)^* - D^*] < 0.
\]
If only briefly, it is worth going through the mechanism by which the economy is in stagnation. At the core of the problem is a tight budget constraint for the young that drives down the equilibrium real rate clearing the market for saving by the middled-aged, possibly to negative territory. Despite nominal wage rigidities, this would not be a problem if expected inflation and the domestic inflation target were high enough. The central bank could set a non-negative nominal rate sufficiently low for the bond market to clear at the natural rate. That is to say, a tight constraint $D_t$ and nominal rigidities are not sufficient to raise the risk of long-run output gaps. What is crucial is that the markets coordinate expectations on a low, possibly negative, rate of inflation, causing nominal policy rates to be constrained at their effective lower bound. In this equilibrium, the monetary stance is endogenously contractionary, causing the output gap to remain open on a permanent basis and thus validating the adverse private sectors expectations.\footnote{It is worth stressing that prices are fully flexible. With competitive firms, they are equal to marginal costs—firms are on their labor demand. With nominal wage rigidities, however, workers are not necessarily on their (vertical) labor supply. An insufficient demand in the good market at the equilibrium real interest rate reduces the demand for labor below full employment.}

2.8 Equilibrium definition in the small open economy

Given initial conditions $\{Y_{-1}, NFA_{-1}, P_{-1}^*, P_{H,-1}\}$ and for given variables in the rest of the world $\{D^*, r^*, Y^*, \Pi^*, P_t^*\}$, an equilibrium in the domestic economy is a set of sequences $\{C_t, Y_t, Q_t, S_t, P_{H,t}, P_{F,t}, P_t, \Pi_{H,t}, \Pi_t, \epsilon_t, i_t, r_t, NFA_t, D_t\}$ that solve equations (4)-(5),(8)-(15), equations $\Pi_{H,t} \equiv P_{H,t}/P_{H,t-1}$ and $\Pi_t \equiv P_t/P_{t-1}$, equation $D_t = D^*$, and the policy rule (18)-(19).

Throughout the paper, we will posit that the small open economy faces a global secular stagnation, a situation in which all its trading partners are permanently trapped in an equilibrium with deflation, zero nominal interest rates, and inefficient output gaps. From the perspective of our economy, this means a stagnating external demand, and inefficiently high real rates, via the equilibrium conditions in the international bond markets. We will explore how a small open economy can cope with this, first looking at its steady states, then at the transition dynamic.

3 Macroeconomic equilibrium in the small open economy

In our baseline specification, the two countries have symmetric features as regards frictions and potential output, as well as policy parameters (e.g. inflation target). Given that the borrowing constraint $D_t^* = D_t$ is symmetrically tight, when the ROW is in a secular stagnation steady state, there exists a steady state in which also the small open economy is in stagnation.
But, as the following proposition states, with integrated world goods and bond markets, such equilibrium is not unique. There is also a second steady state, characterized by full employment, inflation on target, and a strictly positive nominal interest rate.

**Proposition 1.** If $\omega > 0$, the small open economy can find itself in one of two steady states. The stagnation steady state is characterized by purchasing power parity $Q = S = 1$ and zero net foreign assets $NFA = 0$. Conversely, the full employment steady state has $Y = Y^f$ and $(1 + i) = \bar{\Pi}/\Pi^* > 1$, and is associated with a trend nominal depreciation, permanently depreciated real exchange rates, $Q > 1$ and $S > 1$, and a non-zero stock of net foreign assets $NFA$, which is positive if $\sigma > 0$ is above some threshold $\tilde{\sigma}$, approximated up to the first order by $1/(2 - \omega)$.

*Proof.* See the appendix.

3.1 The full-employment steady state

Proposition 1 illustrates that a small open economy can find itself in a full employment steady state even if the rest of the world is not.\(^4\) Intuitively, it can “export the problem”, in that domestic full employment requires a weaker real exchange rate, so to increase the world demand for the country’s output. For a high enough trade elasticity, this allows the country to export its excess saving, and build up net foreign assets.

To dig deeper into the adjustment mechanism, observe that, by the Phillips Curve, full employment is not attainable at a negative inflation rate. In the full employment steady state, domestic inflation must necessarily be higher than in the secular stagnation equilibrium, driving the nominal interest rate above the zero lower bound. By the UIP condition, this also implies that the small open economy must experience positive trend depreciation, at a rate determined by the ratio of the domestic inflation and the negative inflationary drift abroad:

$$\frac{\xi_{t+1}}{\xi_t} = (1 + i) = \bar{\Pi}/\Pi^* > 1,$$

(23)

It follows that a full employment steady state is feasible only under exchange rate flexibility. If domestic monetary policy pursues a fixed exchange rate, the domestic policy makers must accept an inflation rate identical to the international one, which is negative and associated with stagnation.

However, a higher rate of inflation does not translate into a lower real rate. With integrated financial markets, the real interest rate in the domestic economy is pinned down by their

\(^4\) As in EMSS, under the conditions stated in the proposition, both steady states are (locally) determinate. If by contrast $\sigma$ is very low, approximately below $(1 - \omega)/(2 - \omega)$, both steady states are explosive.
ROW counterpart up to (expected) changes in the real exchange rate

\[(1 + r_t) = (1 + r^*_t) \frac{Q_{t+1}}{Q_t}, \quad (24)\]

where we have combined equations (6) through (9). In steady state, the real exchange rate must be constant, such that \((1 + r) = (1 + r^*).\) As a result, from the perspective of the small domestic economy, the domestic real interest rate is exogenous in steady state and therefore the same in both the employment and stagnation steady state, with two key implications.

First, since the real interest rate is exogenous from the vantage point of the SOE, as long as domestic inflation is above zero (or more in general above the lowest level of inflation associated with a permanent output gap), it is neutral as regards the allocation. The domestic monetary authorities can pursue any (non negative) target, and simply let the nominal interest rate depreciate at the rate implied by the UIP condition (9).

Second, for a given real rate, full employment is not achievable without a boost in foreign demand, requiring real depreciation and the accumulation of foreign assets/liabilities. From (14), equilibrium in the asset market requires that domestic savings (by the middle-aged) equal domestic borrowing (by the young) plus the net foreign asset position.

\[B^m_t = -B^y_t + NFA_t,\]

As already discussed, the stagnation steady state can be seen as the result of excessive desired savings that cannot be accommodated at full employment, because, given monetary policy (18), the real interest rate remains stuck above its market clearing level, in turn generating a negative output gap. Proposition 1 establishes that, for high enough trade elasticity, the country achieves full employment by taking its excess savings abroad and acquiring assets on foreigners. The proposition however also makes it clear that this is not the only possible equilibrium outcome. We turn to this issue next.

### 3.2 Exporting versus devaluing domestic savings: the possibility of beggar-thyself depreciation

From theory, we know that real exchange rate movements have contrasting effects on demand and welfare. Real depreciation makes domestically produced goods cheaper, redirecting world demand towards them. For given output, however, it also reduces the international value of domestic production. Everything else equal, this makes domestic residents poorer. With incomplete markets, the income effects from depreciation tend to be strong in equilibrium, as they are not mitigated by risk diversification via financial markets. They can actually become stronger than the substitution effects (see Corsetti et al. (2008b) and Corsetti et al. (2008a)).
To see the implications for our analysis, consider a trade elasticity just below (but not far from) $\bar{\sigma} = 1/(2 - \omega)$, a number in between one half and one.\footnote{See the Appendix for a derivation and discussion.} A steady state equilibrium with full employment exists, associated with real depreciation. But the rate of depreciation is so large that, when the economy moves from secular stagnation to full-employment output, the national income valued at international prices actually falls. The contraction in income in turn reduces the value of domestic savings, causing the country to become an international debtor in equilibrium. As a result of the adverse terms-of-trade movements, domestic consumption falls.

The main lesson is apparent. For a range of low trade elasticities, a country can still escape secular stagnation via depreciation. But strong income effects from the adverse movements in the terms of trade create a trade-off by which the full-employment steady state may not be welfare improving. Unless there are large utility gains from preventing involuntary unemployment, of the kind advocated by Schmitt-Groh´e and Uribe (2015), a “currency war” can be beggar thyself.

3.3 A graphical synthesis

Figure 1 summarizes the previous discussion graphically, depicting equilibrium in the domestic asset market for both the case of a high trade elasticity (left side) and a low trade elasticity (right side). The figure plots domestic savings (by the middle-age generation, = $B^m$ in (3)) and domestic borrowing (by the young, = $-B^y$ in (2)) against the domestic real interest rate $r$ (upper panel) as well as against domestic output, $Y$ (the lower panel).\footnote{We assume in the graph that savings are upward sloping in the real interest rate, which holds as long as $\rho > 1$. We do, however, not require this assumption for any of our results.} Recall that both savings and borrowing are denoted in real terms, or more precisely, in terms of domestic consumption.

When the trade elasticity is high (left side), under full employment, domestic savings ($B^m_{\text{full}}$) exceed domestic borrowing at the prevailing world real interest rate $r^*$: the difference is made up by a positive net foreign asset position. Conversely, in a symmetric (stagnation) steady state, $NFA = 0$ and the excess savings must be “absorbed” by the domestic economy. Given that $r = r^*$ and hence the level of domestic borrowing is fixed at $D/(1 + r^*)$, equilibrium requires a reduction in the level of desired savings. Savings fall as the real exchange rate appreciates relative to the case of full employment, and reduce the demand for domestic output.

A close-up on the mechanism is shown in the lower panel, again for a high level of the trade elasticity. Borrowing does not depend on output, but desired savings increase in the level of
domestic production. This is because the level of domestic income valued at international prices (equal to $P_H Y/P$, see equation (14)) is positively sloped in domestic production. Thus, a reduction in desired savings requires a reduction in domestic production, as the economy moves from $Y^{full}$ to $Y^{stag} < Y^{full}$. The fall in output is what shifts the savings curve to the left in the upper panel ($B^{m,stag}$), to restore equilibrium in the domestic credit market.

The picture is quite different when the trade elasticity is low (right side of the figure). Domestic income hence domestic savings fall in the level of domestic production (the $B^m$ curve in the lower right panel is backward bending). This is because, when domestic and imported goods are highly complementary, a higher level of domestic production is absorbed only when its price falls dramatically, such that, valued at international prices, the value of domestic income is actually reduced. As a result, when the economy moves from stagnation to full employment, its excess savings are compressed in value by so much that the economy becomes

Figure 1: Graphical representation of equilibrium in domestic asset market.
a net debtor vis-à-vis the rest of the world: $B_{m,full}$ moves to the left of $B_{m,stag}$ in the upper right panel of Figure 1.

4 Transition to full employment

We have established the existence of a full-employment steady state for the small domestic economy. In this section, we rely on numerical analysis to study how the domestic economy can escape stagnation by solving explicitly for the transition path to full employment. We design our exercises taking advantage of the fact that the equilibrium in the model is globally indeterminate, in that the dynamics can be affected by “sunspot shocks”. Starting from deep recession, we posit that a change in beliefs triggers transition to the full employment steady state.\(^7\)

4.1 The escape path

Given that the whole world is in a global secular stagnation, we now show, when a shift in market expectations move a single country towards full employment, this experiences a large upfront nominal and real depreciation, as well as a temporary rise in both nominal and real interest rates relative to the initially depressed steady state. In the process, the domestic economy steadily recovers and, depending on the trade elasticity, either runs current account surpluses or current account deficits. The transitions for either case are displayed in Figures 2 and 3 below. In these and the following exercises below, we use the parameter values adopted by Eggertsson et al. (2015), drawing on the literature for the extra ones, that is, home-bias in demand and trade elasticities.\(^8\) These are set equal to $\sigma = 1.001$ in Figures 2 and equal to $\sigma = 0.46$ in Figures 3.

Many features of the transition are similar in the two figures. What drives the transition is, first and foremost, a change in expectations by market participants, that sets the economy on a higher inflation path, away from stagnation. As output rises, real depreciation is required to create enough demand for the domestic goods. In the long run, the real exchange rate must be permanently weakened—reflecting the relative abundance of the domestic good in the world markets under domestic full employment. The real interest rate rises along the transition path, driven by expected real depreciation. Upon approaching the new steady state, the real

\(^7\)See earlier models of inflation targeting under a zero lower bound constraint (for example Benhabib et al. 2001). See Benhabib et al. (2002) for a discussion on how transition to the zero lower bound steady state can be ruled out in a closed economy. See Cochrane (2011) for a general discussion on such “ruling out an equilibrium path”. See Mertens and Ravn (2014) for “optimism” versus “pessimism” affecting dynamics under global indeterminacy in a closed-economy New Keynesian model.

\(^8\)In particular, the parameters values used are: $\beta = 0.96, \alpha = 0.85, \gamma = 0.9, \omega = 0.2, \rho = 1, L = 1, D = 0.32, \bar{\Pi} = 1$
Figure 2: Example transition to full employment: high trade elasticity.

rate eventually settles down on its pre-transition value, by equation (24).
Persistent nominal depreciation accommodates the equilibrium real depreciation, and, in addition, reflects the difference between the domestic inflation target and the deflationary drift in the ROW—as discussed above, escape from stagnation requires domestic inflation to outpace foreign inflation, implying trend depreciation. The nominal interest rate jumps up from UIP condition (9), and comes down again gradually as the speed of nominal depreciation subsides. In the long run, the nominal interest rate is pinned down by the Fisher equation (8), and corresponds to the real interest rate \((1 + r^\ast)\) (exogenous to the domestic economy) times the domestic inflation target.

Some features of the transition are instead markedly different in the two figures. Along the recovery path, the country builds up net foreign assets in the case of a high trade elasticity (Figure 2), but runs an external deficit in the case of a low trade elasticity (Figure 3). The lower middle panel shows that domestic savings rise during the transition to full employment
when the trade elasticity is high, but fall when the trade elasticity is low. In this case, the strong depreciation causes domestic income to fall at international prices as the economy moves towards full employment.

In both Figure 2 and Figure 3, the initial increase in the real rate tends to exacerbate the credit constraint faced by the young, reducing their borrowing and thus their consumption. Yet in Figure 2, all generations gain in terms of expected utility (as this is a function of consumption only): the contraction of consumption when young is more than compensated by the consumption gains over their life cycle—a ‘jam-tomorrow’ result from the switch to a full-employment equilibrium. The life-cycle consumption turns negative in Figure 3, where large adverse terms of trade movements clearly immiserize every generation.

Note that in one key dimension the escape path above is reminiscent of Svensson’s "Foolproof Method" to escape a liquidity trap in an open economy: what jumps-start the economy is an increase in inflation strictly associated with a persistent weakening of the nominal and real
exchange rate (Svensson 2001 and Svensson 2003). However, Svensson focuses on the escape from a temporary liquidity trap, assuming a unique steady state. In this context, because of the presence of nominal rigidities, a boost in demand and depreciation requires a fall in real rates.

In Figures 2 and 3, instead, depreciation and inflation are associated with a temporary rise in real interest rates—a common result in contributions modelling the escape from a liquidity trap as a transition between two, stagnation and full employment, steady states—see, e.g., Schmitt-Grohe and Uribe (2012) or Cochrane (2011).

Nonetheless, also in our small open economy it is possible for the real interest rate to fall during the transition. In the next subsection, we will study what can give rise to a dynamic adjustment with such features.

4.2 Valuation effects and macroeconomic dynamics along the escape path

The implications for macroeconomic dynamics from different trade elasticities are apparent from a comparison of Figures 2 and 3. The rate of depreciation is higher, in the economy with the lower trade elasticity. When these are low enough, domestic consumption actually falls on impact, driven by a contraction in income and wealth, and keeps falling towards a new, lower, steady state level. Most strikingly, the country runs an external deficit, becoming an international borrower. In this subsection we further explore these implications.

Which elasticity is relevant for the analysis? As is well know, there is little consensus in the literature. By and large, macro time-series estimates tend to yield values on the low side, ranging from as low as .3 to 2. Micro and trade estimates tend to yield much higher values, in the range of 2 to 4 or even higher. There is nonetheless consensus that trade elasticities are not constant over different time horizons, prompting several studies to investigate the reasons for this difference (Ruhl (2008), Crucini and Davis (2016)).

In light of the debate in the literature, and the uncertainty surrounding the structure of international trade in a world in secular stagnation, it may not appropriate to rule out the possibility of low elasticities a priori. In what follows, we construct a numerical example drawing on the empirical and quantitative evidence making a strong case for letting elasticities differ as a function of the time horizon.

9Valuation effects may be so large that the steady state is explosive, and a transition path may not exists under rational expectations. The elasticity is selected to be the smallest for which the steady state is not explosive.

10As regards macro studies, Taylor (1993) estimates the value for the U.S. to be 0.39, while Whalley (1984) reports a value of 1.5. For European countries most empirical studies suggest a value below 1. For instance, Anderton et al. (2004) report values between 0.5 and 0.81 for the Euro area. See the comprehensive study on G-7 countries by Hooper, Johnson and Marquez, 2000. As regards micro studies, for instance, Bernard et al. (2003) finds a value as high as 4.
In Figure 4, we set the elasticity just above .45 at the beginning of the escape path, and increase it gradually to 3 as a function of time. A number of striking results emerge. The exchange rate needs to adjust in nominal and real terms much more at the beginning of the transition, so does inflation. The real exchange rate actually overshoots its long-run value upfront, and appreciates during the transition. By implication, the real interest rate falls, implying that domestic borrowing temporarily rises together with saving. Most remarkably, despite the return of inflation to its target level, the nominal interest rate remains at the zero lower bound for some time.

Our exercise suggests that, with time-varying elasticities along the escape route, the interest rate in a small open economy may remain at the ELB on impact even when the economy starts to recover. It may take some time before the improvement in macroeconomic conditions

\[\text{In particular, the parameters values used are: } \beta = 0.96, \alpha = 0.85, \gamma = 0.9, \omega = 0.2, \rho = 1, \bar{L} = 1, D = 0.32, \bar{\Pi} = 1, \text{low } \sigma = 0.46 \text{ and high } \sigma = 1.\]
and persistent inflation allows the policy rate to return to positive territory. During the ELB spell, the economy actually experiences some exchange rate appreciation, after an initial overshooting of the currency new equilibrium (depreciated) level.

5 Reforming the monetary policy framework

A key result of the secular stagnation literature is that, with policy rates stuck at their lower bound, real interest rates can endogenously rise above the market clearing level world-wide in steady state, depressing demand and generating negative output gaps forever. From a different perspective, at the equilibrium real rates, domestic savings cannot be absorbed at full employment, given that there are insufficient savings vehicles in the domestic economy. In closed economy context, there is an argument for either increasing the target inflation, or lowering the effective lower bound constraint, i.e. set negative policy rates, in an attempt to enhance the ability of monetary policy to stimulate demand. In this section, we discuss the effectiveness of either measure in a small open economy in turn.

5.1 A higher inflation target

As discussed in Eggertsson and Mehrotra (2014), raising the inflation target in a closed economy can be helpful to the extent that the target is set above the negative of the natural real interest rate. For a high enough target, the full employment steady state necessarily exists—and is characterized by a strictly positive nominal interest rate. However, a revision of the target by itself does not rule out the stagnation steady state. In this sense, the measure is less effective as a tool for forward guidance, than in economies where the duration of the zero lower episode is finite (Eggertsson and Woodford 2003).

In the context of our small open economy with integrated financial markets, the policy’s benefits are even subtler. Given the real interest rate (set by arbitrage in international financial markets), a revision of the target by itself cannot lift the economy out of stagnation by lowering the (long) real rate (the duration of the ZLB spell being infinite). Nor can it affect the existence of the two steady states. From our analysis at the beginning of this Section, recall that two steady states can exist even for an inflation target that would imply uniqueness of the stagnation steady state if the domestic economy were closed (as it would be perfectly symmetric to the ROW).

What can be altered via a change in the inflation target is the transition to the full employment steady state discussed in Section 4. Consider Figure 2, for instance. Along the escape path, per effect of shifting expectations, domestic policy makers hit their inflation target almost instantly, as the zero lower bound ceases to bind in the period of the lift-off. Thus with a
higher inflation target, the recovery is accompanied by higher levels of inflation, with two key implications. On the supply side, from the Phillips Curve (16), output recovers more quickly, by relaxing the downward constraint on nominal wages at a faster pace. On the demand side, the transition is fostered by faster depreciation towards the new steady state level of the exchange rate.

5.2 A lower effective lower bound (ELB)

When the ELB is lowered to negative territory, (18) and (19) change to

\[ \Pi_{H,t} = \bar{\Pi} \text{ subject to } i_t \geq -\tilde{i}_{ZLB}, \]

or alternatively

\[ i_t = -\tilde{i}_{ZLB} \text{ if } \Pi_{H,t} < \bar{\Pi}. \]

Here, \( \tilde{i}_{ZLB} > 0 \) denotes the degree of effective relaxation of the zero lower bound constraint. A key result is that resetting the ELB in a stagnation steady state makes inflation more negative, and thus exacerbates the underemployment problem. From the Fisher equations (7) and (8) we have that

\[ \Pi = 1 - \tilde{i}_{ZLB} \frac{1 + \gamma}{\Pi} = (1 - \tilde{i}_{ZLB})\Pi^* \leq \Pi^*, \] (25)

where we again have used that \((1 + r) = (1 + r^*)\) in steady state. That is, as \( \tilde{i}_{ZLB} > 0 \) and the economy is in the stagnation steady state, the economy must experience deflation for the Fisher equations (both domestically and abroad) to be satisfied. In turn, from Phillips curve (16), a greater rate of deflation domestically widens the domestic output gap

\[ Y^f \left( \frac{1 - \gamma/(1 - \gamma)}{\Pi}\right)^{\frac{\alpha}{1 - \alpha}} < Y^f \left( \frac{1 - \gamma/\Pi^*}{1 - \gamma}\right)^{\frac{\alpha}{1 - \alpha}}, \]

such that as a result, \( Y < Y^* < Y^f \), and the domestic recession becomes more severe—in fact, deeper than the recession in ROW. The real exchange rate actually strengthens.

The dynamic of the domestic economy in response to a ELB adjustment is illustrated by Figure 5, which shows the transition to the new and worse steady state, with even deeper stagnation. Observe that, with the reduction in nominal interest rates to negative values, the nominal exchange rate is set on a path of permanent appreciation, again reflecting the

\[ \text{By repeating the experiment from Figure 2, but under an inflation target which has been raised slightly, we note that output recovers more quickly, and at some point jumps to potential straight away, in the period where the wage constraint ceases to bind altogether. This occurs when } \Pi_{H,t} > \left( \frac{Y^f}{Y_{t-1}} \right)^{\frac{1}{1 - \alpha}}, \text{ recall equations (16) and (17).} \]
UIP condition (9). Output stagnates, and the real exchange rate appreciates, reflecting the relative abundance of the ROW-produced good relative to the domestic good in the new steady state. As output collapses, domestic savings are reduced, which leads to persistent current account deficits and an accumulation of net foreign debt. Lastly, the real interest rate temporarily falls in anticipation of an appreciation of the real exchange rate, as a result of the UIP condition in real terms (24). Thus, somewhat paradoxically—and in line with our discussion in Section 4—the real interest rate actually falls precisely as output collapses to a permanently lower level.

It is worth stressing that a lower ELB implies that the real interest rate falls more upfront, boosting domestic demand and generating a current account deficit. The country imports more foreign saving.

As it turns out, the previous results again are driven by the fact that the domestic economy is open and financially integrated with the rest of the world. To appreciate this point fully,

\[ 1 - \tilde{i}_{ZLB} = \frac{\tilde{E}_{t+1}}{\tilde{E}_t}, \]

combined with equations (22) and (25).
consider the case of complete autarky, without trade in assets and goods—the latter requiring \( \omega = 0 \). In autarky the domestic stagnation steady state is determined by the analog of equations to (20) and (21) written for the domestic economy, and by setting \( i = -\bar{i}_{ZLB} \). As one can easily verify, in this case lowering the effective lower bound actually raises output, and reduces deflationary pressure, thereby bringing the economy closer to the full-employment equilibrium. Figure 6 exemplifies this result by repeating the experiment from Figure 5, but now assuming that the domestic economy is completely closed. The figure clearly shows that, as a result of the rate cut, output recovers—albeit not to potential—along with a decline in the domestic real interest rate.

As already explained, the divergence between closed and open economy crucially results from the fact that, in the latter, domestic real interest rates are determined in the world capital markets. In a closed economy, by manipulating the domestic nominal interest rate, it is instead possible to affect the domestic real interest rates in the long run. In an open, financially integrated economy, by contrast, manipulating nominal rates necessarily translate into deflationary adjustment in the long run, as a result of Fisher equation (8) combined with real interest rate parity.

As a final remark, note that changing the ELB is irrelevant if the policy rate is positive.
It follows that the measure is irrelevant along the escape transitional dynamics as long as, along the path, the zero lower bound is never a binding constraint—as in Figures 2 and 3. It may be useful instead, in a scenario like the one depicted by Figure 4. With time-varying elasticities, the nominal rate may remain constrained at the ELB in the initial phase of the recovery. Once the economy is on this escape path, a reduction in the ELB allows a faster recovery, shortening the length of time in which monetary policy is constrained.

6 Asset supply policy, financial frictions, and the accumulation of net foreign assets

In this section, we elaborate on the idea that the size or even the sign of the current account is sensitive to asset-supply policy, and to the possibility that the equilibrium exchange rate depreciation has an adverse effect on domestic financial frictions.

6.1 Increasing the supply of domestic assets

We now analyze the effects of loosening domestic credit conditions via policies that increase the amount of lending to the young: a larger \( D > D^* \). As established in Eggertsson and Mehrotra (2014), in a closed economy context this policy raises the natural real interest rate by increasing borrowing by the young, while at the same time reducing saving by the middle-aged.\(^{14}\) As a result, the output gap narrows in the stagnation steady state, and the rate of deflation is similarly reduced, such that the policy has an overall favourable effect on the economy.

In an open economy context, the same policy has no effect in steady state: precisely, the policy is neutral in terms of real rates and, under the EMSS specification (with inelastic labor supply), aggregate output. However, it does affect the level of the real exchange rate and the country’s net foreign asset position. Precisely, foreigners end up raising their holdings of domestic assets, while the real exchange rate appreciates.

More formally, in steady state, the domestic real interest rate is nailed down by the real interest rate in the ROW, from equation (24). Similarly, the rates of deflation in the two countries must by synchronized from the two Fisher equations (7) and (8)

\[
\Pi = \frac{1}{1 + r} = \frac{1}{1 + r^*} = \Pi^*,
\]

where we have used that nominal rates are zero in both economies. As a result, from Phillips curve (16), output gaps in the two countries are aligned in steady state, too. From the credit

\(^{14}\)The latter follows from the fact that, if the household accumulates greater debts while young, it has fewer assets to save from when middle-aged.
market equilibrium (14), we observe that changes in $B^y$ and $B^m$, as a result of changes in $D$, must then be reflected in changes in the country’s net foreign asset position.\footnote{Again, the divergence between closed and open economy thus results from the fact that in the former, the domestic and ROW real interest rates can differ, because equation (24) is not an equilibrium condition in this case. As a result, domestic macro-prudential policies can push domestic real interest rates in a favourable direction. By way of contrast, this is impossible in an open economy where domestic real interest rates are determined on world capital markets.} Figure 7 shows this diagrammatically. We note that, once the policy has been implemented, in the new steady state desired borrowing exceeds domestic savings. The gap must be filled by capital inflows and, as a result, current account deficits.

Two comments are in order. First, even when neutral in an aggregate sense, an increase in the supply of domestic assets has distributional effects: it affects relative consumption and utility across generations. From a domestic vantage point, the policy may be worth pursuing for distributional reasons. Second, by containing eternal surpluses and moderating real depreciation, raising the supply of domestic assets reduces the cross-border negative spillovers from the escape from stagnation. The country does not dump its excess saving in the international markets, so it does not exacerbate the secular stagnation problem at global level. While spillovers from unilateral initiatives of individual small open economies are small, they become relevant if many countries follow the same route. Asset-supply policies thus naturally qualify as a key item in the agenda for a coordinated policy response to secular stagnation.

### 6.2 Depreciation of domestic collateral

A point that we have not explicitly discussed in our analysis so far is that real depreciation may end up exacerbating domestic financial frictions. In our baseline specification, the borrowing
constraint on the young is expressed in units of consumption, discounted at the market real rate. Hence the consumption of the young changes with the real exchange rate, only to the extent that its dynamics is reflected in the interest rate.

Consider now a different specification, where the borrowing limit $D_t$ is specified in output rather than consumption units. Under the new specification, real depreciation directly affects the constraint, causing it to be more stringent. Intuitively, the collateral against which the young can borrow (the output they will produce when middle aged) becomes less valuable at international prices. Thus, other things equal, real depreciation directly produces a contraction in domestic borrowing. The NFA equation (14), becomes

$$NFA_t = \frac{P_{H,t} - 1}{P_t} \left[ \frac{-D_t}{1 + r_t} + \frac{Y_t}{1 + \left[\beta(1 + r_t)^{1 - \rho} - \frac{1}{\rho}\right]} - \frac{P_{H,t-1}}{P_{t-1}} D_{t-1} \right], \quad (26)$$

There are at least a notable difference from to our results so far. When the economy moves from the stagnation to the full employment steady state, $Y$ raises relative to $D$, unambiguously translating into a positive net foreign asset position. The extent of real depreciation matters for the size, but not the sign of the change in the external position—the country cannot become a net debtor when moving to full employment. Intuitively, the fall in domestic borrowing translates into larger capital outflows, as the young absorb less saving by the middle-aged.\footnote{In terms of Figure 1, the $-B^y$ line would shift to the left as the economy moves from stagnation to full employment.} If real depreciation exacerbates domestic frictions, escape without the accumulation of external surpluses becomes even less likely than predicted by our baseline model. Possible beggar-thyself effects of depreciation becomes correspondingly more likely.

### 7 Conclusion

The global decline in equilibrium real interest rates and sub-par economic growth has renewed interest in the hypothesis of ‘secular stagnation’. A small open economy exposed to a world which is permanently depressed—negative output gap, less-than-full employment, and nominal interest rates close to their zero bound constraint—faces challenges going beyond conventional prescriptions for stabilization policy. This paper establishes this formally in an OLG framework à la Eggertsson and Mehrotra (2014). We expand on the existing results by taking the vantage point of a small open economy framework facing a downward sloping demand curve for its own exports. The underlying message of the paper is that a small open economy can escape stagnation relying on integrated goods and financial markets. The key feature of the escape is that, with high trade elasticities, surplus countries attain full employ-
ment by increasing the foreign demand for their goods and using other countries’ liabilities as savings vehicles: the domestic country can ‘export the problem’ by weakening its exchange rate and building up net foreign assets.

Our analysis bears key lessons for theory and policy. In a global secular stagnation, current account surpluses create the conditions for full employment at home, by absorbing the desired saving by domestic residents without output and employment adjustment. Countries may attain full employment by using other countries’ liabilities as savings vehicles. In this sense, neo-mercantilism has an ‘old Keynesian’ rationale. However, in economies with a low trade elasticity, or when the government pursues asset-supply policies, the escape actually takes place together with a contraction in domestic excess saving associated with current account deficits. Despite the accumulation of external debt along the transition path, also in this case nominal and real interest rates need to rise above their previous steady-state values.

Indeed, at the core of the escape from stagnation, is not the mere opportunity for a small open economy to dump its excess saving in the international financial market (or more in general to generate external imbalances taking advantages of foreign demand). Rather, the adjustment mechanism ultimately rests on preventing a steady drop in the rate of domestic inflation driven by the global deflationary drift. This is the core domestic and Neo-Fisherian dimension of the adjustment, which in an open economy requires permanent nominal exchange rate depreciation. Higher inflation, however, does not drive the real interest rate to its natural level. With the real interest rate fixed at world level, indeed, attempting to lower the effective zero-bound on nominal domestic rates is generally counterproductive. At the same time, both along the transition and in steady state, the real exchange rate must be sufficiently depreciated to ensure that domestic income and desired savings, as well as external demand, are consistent with convergence to full employment in the long run. This is the external dimension of the adjustment.

These two dimensions interact significantly because real depreciation produces both substitution and income effects, the latter including output valuation effects that may be quite strong—especially when short run trade elasticities are realistically low.

While we analyze income effects of depreciation calling attention to trade elasticities, we are fully aware that there are many other possible features of the economy that may reinforce them. A particularly important one is the composition of a country’s gross assets and liabilities, going beyond the value of labor endowment/human capital (as we have in our model), to include physical capital and external assets and liabilities. If the small open economy has an initial stock of foreign wealth denominated in the foreign currency, real depreciation along the escape path will create valuation effects that could be adverse (if foreign wealth is negative,
i.e. debt) or positive (if foreign wealth is positive, e.g. international reserves), but in all cases will influence consumption and welfare along the escape path and possibly in steady state. The aggregate dynamics and distributional effects across generations will in turn depend on who owns these assets (public vs private), and intergenerational government policy. We leave to future work an exploration of these intriguing directions of research.

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8 Appendix

Here we provide proof for the proposition 1 from the main text. Throughout, we assume that ROW is in the stagnation steady state (which will be true once \( D^* > 0 \) is small enough). In this steady state, \( \Pi^* < 1 \), \( Y^* < Y_f \) and \( 1 + r^* > 1 \) solve the following set of equations

\[
Y^* = Y_f \left( \frac{1 - \gamma/\Pi^*}{1 - \gamma} \right)^{\frac{\alpha}{1 - \alpha}} \tag{8.27}
\]

\[
\frac{D^*}{1 + r^*} = \left( 1 + [\beta(1 + r^*)^{1-\rho}]^{-\frac{1}{\sigma}} \right)^{-1} [Y^* - D^*] \tag{8.28}
\]

\[
1 = (1 + r^*)\Pi^*, \tag{8.29}
\]

where we have used that \( 1 + i^* = 1 \).

The steady state of the model in the domestic economy is then characterized by the following set of equations

\[
NFA = -\frac{D}{1 + r} + \frac{1}{1 + [\beta(1 + r)^{1-\rho}]^{-\frac{1}{\sigma}} \left( \frac{1}{\phi} - D \right)} \tag{A-1}
\]

\[
NFA = (1 + r)NFA + \frac{Y}{\phi} - C \tag{A-2}
\]

\[
Y = \phi^\sigma ((1 - \omega)C + \omega Q^\sigma Y^*) \tag{A-3}
\]

\[
Q = \frac{S}{\phi} \tag{A-4}
\]

\[
1 = \frac{\Delta \epsilon \Pi^*}{\Pi_H} \tag{A-5}
\]

\[
\phi = [(1 - \omega) + \omega(S)^{1-\sigma}]^{\frac{1}{1-\sigma}} \tag{A-6}
\]

\[
(1 + r) = (1 + r^*)\Delta Q \tag{A-7}
\]

\[
(1 + i) = \Delta \epsilon \tag{A-8}
\]

\[
Y = \begin{cases} 
Y_f \left[ \frac{(1-\gamma/\Pi_H)}{(1-\gamma)} \right]^{\frac{\sigma}{1-\sigma}} & \text{otherwise} \\
Y_f & \text{if } \Pi_H \geq \bar{\Pi} 
\end{cases} \tag{A-9}
\]

\[
\Pi_H = \bar{\Pi} \text{ or } 1 + i = 1 \tag{A-10}
\]

In steady state the real interest rate in the domestic economy will be the same as the real rate in ROW. So from (0-3) \((1 + r) = (1 + r^*) = 1/\Pi^* \) and from (A-7) \( \Delta Q = 1 \). Thus, (A-4) and (A-6) imply that relative prices remain constant, \( \Delta S = \Delta \phi = 1 \).
Using (A-1) and (A-2) in (A-3), we derive an expression for $Y$ in terms of real interest rate $Q$:

$$Y = \phi \sigma [(1 - \omega)(r^*NFA + Y\phi^{-1}) + \omega Q^\sigma Y^*]$$

$$Y(1 - \phi \sigma^{-1}(1 - \omega)) = \phi \sigma (1 - \omega)r^*NFA + \omega \phi \sigma Q^\sigma Y^*$$

$$Y(1 - \phi \sigma^{-1}(1 - \omega)) = \phi \sigma (1 - \omega)r^*(-\frac{D}{1 + r^*} + M [\phi^{-1}Y - D]) + \omega \phi \sigma Q^\sigma Y^*$$

where $M \equiv \frac{1}{\beta(1 + r^*) - 1}$. Combining (A-4) and (A-6) gives $\phi = \left(\frac{1 - \omega}{1 - \omega Q^1 - \omega} \right)^\frac{1}{\tau}$, and substituting for $\phi$ in the previous equation we get:

$$Y(\omega Q^1 - (1 - \omega Q^1)M) = -(\frac{1 - \omega}{1 - \omega Q^1 - \omega})^{\frac{1}{\tau}}(1 - \omega)r^*(\frac{1}{1 + r^*} - M)D + \omega(\frac{1 - \omega}{1 - \omega Q^1 - \omega})^{\frac{1}{\tau}} Q^\sigma Y^*$$

(A-14)

So, the intersection(s) of (A-14) with (A-9) give the steady states of the system. We proceed by checking if an intersection is possible for different values of the equation (A-9).

Case 1 Suppose that $Y = Yf \left[\frac{(1 - \gamma/\Pi_H)}{(1 - \gamma)}\right]^\frac{1}{\tau}$ and $i = 0$. Then from (A-8) $\Delta \varepsilon = 1$, and from (5) $\Pi_H = \Pi^*$, such that $Y = Y^*$. From the definition of $Q$ in equation (4) in the main text, $Q = 1$, and the home economy is in steady state.

Case 2 Suppose now that $Y = Yf = 1$ and $\Pi_H = \bar{\Pi} = 1$. In this case from (A-5) $\Delta \varepsilon = \frac{1}{\Pi^*}$ and thus from (A-8) $(1 + i) = \frac{1}{\Pi^*}$. Then, equation (A-14) gives

$$(\omega Q^1 - (1 - \omega Q^1)M) = -(\frac{1 - \omega}{1 - \omega Q^1 - \omega})^{\frac{1}{\tau}}(1 - \omega)r^*(\frac{1}{1 + r^*} - M)D + \omega(\frac{1 - \omega}{1 - \omega Q^1 - \omega})^{\frac{1}{\tau}} Q^\sigma Y^*$$

and substituting for $Y^*$ gives a polynomial expression for $Q$

$$(\omega Q^1 - (1 - \omega Q^1)M) = -(\frac{1 - \omega}{1 - \omega Q^1 - \omega})^{\frac{1}{\tau}}(\frac{1}{1 + r^*} - M)D[(1 - \omega)r^* - \omega Q^\sigma \frac{1}{M}]$$

To show the full employment state is a steady state, it suffices to show that the above equation has a real root.